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**Project ID: 275437420 – 132/11kV LEACHES BAY SUBSTATION –  
PHASE 3 BCMM LEACHES BAY S/S TRFRF UPGRADE  
CONTROL PLANT FINAL DESIGN 2023**

**COMPILED BY:**

**REVISION: 3**

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**SUPPORTED BY:**

**Snr. Engineer Control Plant Project Eng.: HC: GREGG BURGER**

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RALPH REDDY  
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**Date:** .....

## **EXECUTIVE SUMMARY**

Leaches Bay 132/11kV substation is an existing substation that will be upgraded to accommodate the 40MVA firm power requirements of the East London Industrial Development Zone. This will be achieved by additional 2 outgoing Feeder panels, a Third 11kV incomer and an 11kV Bus-Section. It will also include placement of a 40MVA 132/11kV Transformer. Currently there are 14 (Fourteen) outgoing Feeders, 2 (Two) 11kV incomers and 1 (One) 11kV Bus-Section at the substation. There are Two existing Busbars. One Feeder will be added to One side of the existing Busbar and the other Feeder will be added on the newly extended Busbar. The 3CF-4100F scheme will be implemented on the new panels and will be modified to work with indoor breakers and transformer will utilise the 5TM-3100 with the 5JB-3200 scheme.

## **1. INTRODUCTION:**

### **1.1 BACKGROUND**

This document outlines the scope of work to be done at Leaches Bay 132/11kV Substation. The proposal to develop an Industrial Development Zone (IDZ) in East London has been adopted as a result of the Department of Trade and Industry's policy to provide incentives for the development of IDZ's at locations that have good access to harbours and / or airports. The East London Industrial Development Zone (Pty) Ltd (ELIDZ) was formed for the purpose of establishing the East London Industrial Development Zone.

The ELIDZ is made up of representatives of Buffalo City Municipality, Provincial Government, the Eastern Cape Development Corporation, business, labour and parastatals. The current electricity supply to Zone 1 is from the Leaches Bay 132/11kV 2 x 20MVA substation. The Eskom Leaches Bay substation is supplied by 2 x 132kV lines with a transfer capacity of 80MVA. The Leaches Bay substation has fourteen 11kV Feeders currently installed.

The current ELIDZ electrical network is divided into Four supply Zones with limited interconnection between them. Each Zone has a dedicated switching station from which all its MV/LV substations are connected. Zone 1A has Two switching stations due to its high electricity demand and available land still to be developed. The substation feeds Two switching stations within the development Zone and has Two Feeders which feeds residential areas outside of the Development Zone, within Buffalo City Metropolitan Municipality.

Upgrades on the Leaches Bay Substation control room are primarily to supply Two additional switching stations located within ELIDZ. The existing Eskom Leaches Bay substation and the downstream ELIDZs, MV network; has no spare capacity and future load growth to provide the bulk supply for the new tenants and the existing tenants expansion at East London Development Zone. The Industrial Development Zone aims to obtain an additional power supply through creating a redundant power connection and upgrading of Eskom Leaches Bay substation by upgrading the existing substation to include a Third transformer bay with a 40MVA capacity. This will assist in achieving an end state 40MVA firm power supply capacity to the ELIDZ.

The upgrading of the substation to accommodate the additional capacity includes upgrade of ancillary equipment; namely the AC/DC board, Vamp protection panel, Feeder protection on switchboard, transformer protection and metering panels. The scope of works for this package will form part of the Customer Application no.3 Scope of Works.

All upgrades will be completed as per the Eskom self-build policy, where the developer shall design, procure and pre-commission the primary and secondary scope of works.

### **1.2 LOCALITY**

The Eskom Leaches Bay substation is located off Chester Road within the Buffalo City Municipality in the Eastern Cape Province. The location coordinates are: 33° 03'05.22"S and 27°50'47.16"E.

## **OTHER INFORMATION WHICH MAY AFFECT THE WORK IN THIS CONTRACT**

### **a) Existing Electrical Services**

MV/LV Cables and control cables exist within the site and the location of the electricals services are shown on the drawings provided. However, the exact location of the physical service on site may differ in certain instances. The contractor is to ensure that care is taken when excavating or carrying out construction works to ensure that no existing services are impacted during construction. Should there be any discrepancy on existing services on site, the contractor is to inform the project manager of this risk.

### **b) Hidden and other services within the site**

In the event of a discrepancy between physical condition and the information on a drawing, the Contractor shall notify the Project Manager immediately. Furthermore, the project manager should be informed immediately if the physical condition found on site is such that there is a deviation from the drawing which requires a change in the design of the works or result in a possible compensation event.

### **c) Details of existing buildings / facilities which Contractor is required to work on**

Public services and infrastructures are limited, and the *Contractor* shall arrange for the following:

- Sanitation and accommodation on site for own use as specified in the Preliminary and General
- Site Office & Storage
- Portable Water
- Electricity during construction
- OHS
- ECO

## **2. PRIMARY SCOPE OF WORK:**

### **2.1. ELECTRICAL**

- Extend the existing 132kV Tubular Busbar and install 2 x 132kV, 2500A, 40kA H/O isolators.
- Supply and install 1 x Junction box per bay.
- Supply and install 1 x 132kV Circuit Breaker
- Supply and install 3 x 132kV, 2500A, 40kA 2P2M2B (1600) Post Type CT's & PIU Junction Boxes.
- Supply and install a 132/11kV, 40MVA YNd1 transformer.
- Supply and install 3 x 132kV station class surge arrestor (MCOV 84kV) on the primary side of the transformer.
- Supply and install a 3 x 11kV station class surge arrestor (MCOV 12kV) on the secondary side of the transformer and 3 x 11kV station class surge arrestor (MCOV 12kV) after the isolator on entry point of cables.
- Supply and install a 11kV, 300A NECRT for the Third transformer bay.

- Extend Leaches Bay MV board to include additional 1 x 11kV, 2500A incoming Feeder, 1 x 11kV, 2500A Bus-Section breaker and 2 x 11kV, 2500A outgoing transfer switch Feeder breakers.
- Supply and install new 12 x single core 630mm<sup>2</sup> XLPE cables (4 per Phase) from the transformer to the 11kV MV indoor Feeder breaker.
- Supply and install 1 x 132kV outdoor cable end support.

## **2.2. CIVIL**

- Cast a new plinth with related foundations to accommodate the new Third transformer bay.
- Install foundation for Tubular Busbar support and isolators.
- Build a Bund wall to accommodate 110% of a single transformer oil capacity.
- Upgrade existing oil holding dam.
- Extend the existing built-up cable trenches up to the Third Transformer Bay.
- Other required civil; and miscellaneous work

## **3. PHASING OF PROJECT CONSTRUCTION:**

Customer representative to install a new 2 x 11kV Feeder switchboard panels, a Bus-Section and a Third 132/11kV transformer. Eskom to commission the 2 x 11kV Feeder switchboard panels, Bus-Section and the newly installed 132/11kV transformer.

### **3.1.1. PHASING OF PROJECT CONSTRUCTION**

Notice of outage will be given to the Eskom project manager 35 days in advance. The Eskom Project Manager will in turn notify the relevant CNC and Control Centre. The affected customers will be informed by the ELIDZ. The switchboard is to be upgraded such that each half will back-up the other in turn, so no customers are going to be switched off for the duration of the installation and commissioning. The implementation priority of the project is to maintain continuity of supply at all times. To limit the effects of customers being switched off during the construction, the project will be implemented in phases as per Table No. 1 below.

Table 1: Phasing of Project Construction

#### **3.1.1.1. PHASE 1 – OUTAGE NO. 1 (132kV Busbar Extension) – Live Line**

- Extend 132kV Bus-Busbar.
- Battery Charger and Bank Upgrade – Risk of trip

#### **3.1.1.2. PHASE 1 – OUTAGE NO. 2 (132kV Transformer No.3) – Live Line**

- Install 132/11kVA 40VA Transformer No.3

#### **3.1.1.3. PHASE 2 – OUTAGE NO. 3 (11 kV Busbar Extension & Feeders)**

- 11 kV Bus-Section
- 11 kV Transformer Incomer
- 11 kV Outgoing Transfer Feeder 16

#### **3.1.1.4. PHASE 3 – OUTAGE NO. 4 (11 kV Feeder No.15)**

- 11 kV Outgoing Transfer Feeder 15

### **4. PROTECTION**

#### **4.1. TRANSFORMER PROTECTION PANELS:**

##### **4.1.1. 132/11KV TRANSFORMER– PROTECTION PANEL SCOPE**

Supply and install 5TM-3100 protection schemes for power transformers and tap changer on the Third transformer bay with swing frame panel. The selected options are as follows:

- Supply and install a 110V DC Supply
- Complete star delta connection with 360A NEC/R.
- HV Busbar VTs with VTs selection
- Application using TRFR MV VTs
- PIU Junction Box application interface
- Indoor Switchgear as per D-Dt-5408 SHT 7-14
- Standard Outdoor HV Circuit-Breaker as per D-DT- 5407
- Application with 5JB3200(RIO600) AS MV Circuit breaker PIU
- Application with Tap Changer Module
- Standard design drawing
- Single VT application
- Standard Coms option (RS-485/DNP3 & Remote Engineering) connected to Meinberg in remote engineering access panel via SNTP using ethernet.
- IEC 61580 ordering option
- High impedance HV & MV REF for Two-winding TRFR- Two RMS 2V73 relays

The 5TM-3100 scheme designed for protection of distribution transformers larger than 40MVA will be supplied by ABB and incorporate the RET670 relay for the Main Protection Module, REF620 for the Back-Up Protection Module and REG-DA for the Tap Change Module. The basic scheme has an RED670, REF 620 and REG-DA integrated relays comprising of the following protection:

- Two winding differential.
- HV overcurrent & earth fault.
- HV & MV high impedance restricted earth fault.

The scheme is suitable to protect transformers for all vector groups over a wide voltage range. The scheme will be built according to the drawings provided in-line with the Eskom DT standards and will include the PIU and necessary interfaces.

#### **4.1.2. TRANSFORMER PROCESS INTERFACE UNIT (PIU) – 5JB-3200**

The 5JB-3200 scheme designed for distribution transformers larger than 40MVA will be supplied by ABB and be integrated with the 5TM-3100 scheme. The fundamental scheme comprises of the following:

- Standard tap change application
- Neutral electromagnetic coupler (NEC) interface
- Power transformer with cooler fans application
- Standard BCD tap position encoder.
- MV circuit breaker PIU
- Standard design drawing
- Application using TRFR MV / secondary side VTs
- HV / primary-side Busbar VTs with VTs selection
- TRFR MV/secondary-side VTs application
- Standard outdoor HV circuit breaker
- Marshalling interface box
- Transformer relay panel interface
- HV Bus-Zone panel interface

The scheme will be built according to the drawings provided in-line with the Eskom DT standards.

The above transformer scheme & PIU will be used to protect the 132/11kV Transformers using the items tabulated in a Table No. 2.

Proj ID	SAP No.	Short Description	SAP Purchase Description	
Items to be free-issued to HITACHI ENERGY				
		Swing frame panel 2400(h) x 800(w) x 600(d)	Contract No:4600071130	1
Other supporting material to be ordered				
		Transformer PIU Junction box		1
		Fibre Optic Patch box		2
DX698 Contract line Items				
Common Items				
P3.14a	3000031095	CONFIG SEC PLNT EQP:5TM-3100	CONFIGURATION, SECONDARY PLANT	1
P4.6	3000031098	CONFIG SEC PLNT EQP:5TC-3200/5TM-3100	CONFIGURATION, SECONDARY PLANT	1
P15.65	3000028145	CONFIG SEC PLNT EQP:NETW SWITCH	CONFIGURATION, SECONDARY PLANT EQUIPMEN	1
P1.13	3000031189	HNDL MTRL:PANEL;STORE, CRATE AND WRAP	HANDLE, MATERIAL: TYPE: PANEL; METHOD: STO	1
P1.145	0000701933	SWITCH NETW:AFS665SS3G4T4S;TRFR BAY	SWITCH, NETWORK: TYPE: TRFR BAY; PORT	1
P1.148	0000701720	IED:EXTENDED RIO600 BREAKER PIU	DEVICE, INTELLIGENT ELECTRONIC: TYPE:	
Transformer Commodity items				
P3.1a	0000701696	COMP, PROT SCM:5TM-3100 SCM SHELL	COMPONENT, PROTECTION SCHEME:	1
P3.2a	0000701870	SCM, PROT:5TM-3100 MAIN;110 VDC	SCHEME, PROTECTION: TYPE: 5TM-3100 MAIN;	1
P3.4a	0000701874	SCM, PROT:5TM-3100 BACKUP;110 VDC	SCHEME, PROTECTION: TYPE: 5TM-3100	1
P3.5a	0000701698	COMP, PROT SCM:5TM-3100, 2 HIZ REF	COMPONENT, PROTECTION SCHEME:	1
P3.10a	0000701702	COMP, PROT SCM:5TM-3100, HV VSR	COMPONENT, PROTECTION SCHEME:	1
P3.11a	0000701725	IED:BREAKER PIU, RIO600 PIU;110/220 VDC	DEVICE, INTELLIGENT ELECTRONIC: TYPE:	2
P3.12a	0000701726	IED:TRFR PIU, RIO600 PIU;110/220 VDC	DEVICE, INTELLIGENT ELECTRONIC: TYPE: TRFR	1
Tap Change Commodity items				
P4.1a	0000701876	SCM, PROT:5TM-3100 TAP CHANGE; 110 VDC	SCHEME, PROTECTION: TYPE: 5TM-3100 TAP	1

Table 2: Transformer Protection scheme

➤ **Work to be done by *CONTRACTOR*:**

The contractor shall complete the following works on site:

- Establish Site
- Install relevant Primary plant and control plant equipment.
- Procure and delivery equipment with relevant control cables and ancillaries to site.
- Install Panels with the relevant protection schemes and equipment.
- Install and test control cables and communication cables.
- Ensure works are completed in alignment to the Eskom DT Standards
- Quality of works are aligned to Eskom Policies and Procedures.
- Integrate Clerk of Works timeously for approvals where hold points and test, inspection and witnessing is required.
- Ring out all Cables and put labels with ferrules.
- Provide test Certificates and quality documents for Eskom and Engineer to sign.
- Ensure Health and Safety compliance.
- Ensure Environmental Management Plan compliance.
- Install Fibre in protection piping between scheme and PIU.
- Install time synchronization signal cables.

➤ **Work to be done by *CPM Protection*:**

Eskom to complete the commissioning works that are as follows:

- Test signals to control where applicable
- Provide Clerk of works to inspect site for quality of works.



- Inspecting compliance on OHS and Environmental (EMP).
- Sign test certificates and quality documents upon witnessing and inspections.
- 

## **4.2. 11kV FEEDER PROTECTION PANELS**

### **4.2.1. 11KV FEEDERS 15 AND 16 SCOPE**

The scope of works for the 11kV Feeders includes the supply, installation and commissioning of two 11kV Feeder panels at Leaches Bay Substation. The new Feeders will be added to the existing 11kV switchboard which currently has 14 outgoing 11kV Feeders, 2 incoming 11kV Feeders and 1 Bus-Section. The scope outlined for this project for the 11kV board is as follows:

- Install the secondary cables as per the cable block diagram. Internal wiring for the switchboard to be multistrand.
- Supply and install a 3CF-1400F scheme with directional over- current, earth fault and sensitive earth fault.
- Supply and install Reyrolles Argus C 7SR1206-4HA12-2DA0 relays.
- Supply and install a relay communication interface (Fibre /RS232 converter) and fibre optic interface cables that will be used to communicate with the relay to change or apply settings.
- Supply and install an additional rear breaker terminal strip in the scheme to accommodate the indoor breaker.
- Supply and install Fibre types that will be used to create a closed loop between all the Feeder relays and the Fibre/RS232 converter card situated in the remote access computer. The Fibre is to be in a protective piping according to Eastern Cape Eskom standard.
- Supply and install relays that are to be suitable for DNP3.0, MODBUS-RTU, IEC60870-5-103 and ASCII protocol.
- Mount the Feeder schemes in the bucket on the respective switchgear panels.
- Verify that the Actom switchgear vacuum breaker is rated at 2500 A with a short circuit fault level of 25 kA at an impulse level of 95 KV.
- Ensure the schemes are to be purchased from Woodbeam via Actom who will fit the scheme onto the switchgear panel.
- Ensure that the Main protection for all the newly added Feeders is Solkor N protection. The Solkor N 7SR18 Relay will be fitted together with its communication medium to the remove ends. •
- REA link via Ethernet copper ports that daisy-chain from the Substation BBswitch to the feeders and back to the BBswitch in a redundant loop using RSTP.
- Time sync could be provided by either SNTP from the Substation Meinberg Clock to an input on the unit.
- The BB switch could be an 8 port Layer 2 Box Switch (EDS-508A)
- The schemes shall arrive fully fitted on site.
- Supply and install 11kV protection VTs and CTs on the Feeder panels.
- The contractor shall ensure that the scheme is updated to accommodate the indoor breaker in accordance with the previous switchboard upgrade. The scheme options selected are as follows:

- ❖ Sync Check
- ❖ IDF
- ❖ Recorder points
- ❖ Remote access
- ❖ Directional O/C with Diff and Fibre option

The equipment is to comply with the Eskom standards namely:

- The Dx and Tx Specification For 6.6kV to 33kV withdrawable Indoor Metal-Enclosed Switchgear (240-56065131).
- The Dx and Tx specification for 11kV to 33kV fixed pattern metal-enclosed indoor primary switchgear standard (240-56062704). The new switchgear panels and Busbar are to be in line with existing switchgear.
- PK2-GE CT Test blocks are to be installed within the switchboard panels and all wiring is to be multi stranded.
- Install Feeder 15 on the right of Busbar 1A and Feeder 16 shall be installed on the left of Busbar 1C.



Figure 1: 3CF-4100F Scheme

Cable Feeder Protection Scheme				
QTY	SCHEME (MANUF)	PROT AVAILABLE (MODULE) DESCRIPTION	OPTIONS (MODULE) DESCRIP	ENC
2	3CF-4100F (Reyrolle)	<b>Feeder 15 and Feeder 16</b> 1. ARGUS C 7SR1206-4HA12-2DA0 with directional overcurrent, SE/F and	1.Relay communication interface cable. 2.Relay communications interface Fibre/RS232	TBD

		earth fault protection (With fault recording). 110V DC supplied relay. 2.Suitable for mounting in metal clad switchgear. 3. 2 x Protection CT - 2400/1A MR 4. 1 x measurement CT - 2400/1A MR.	converter. Directional overcurrent & earth fault with 3.Solkor N- 7SR18 protection (fibre option). 4.Recorder points	
1	N/A	<b>Bus-Section No. 2</b>  1.Control Switch 2.Selector Switch 3.Remote Trip Close Socket 4.Lamp Test Pushbutton 5. Indication LEDs-open/close 6. Cable Earthed LED 7.ITT PLUG 8.Panel Heater (Cable/Busbar) +Switch	1.T/N/C 2.Remote/Local 3.SCAME 4.Black 5.Green/Red 6.Amber 7.Yes 8.240V AC	
1	N/A	<b>132/11kV Transformer No.3</b>  1.Lamp Test Pushbutton 2. Indication LEDs-open/close 3. Cable Earthed LED 4.ITT PLUG 5.Panel Heater (Cable/Busbar) +Switch	1.Black 2.Green/Red 3.Amber 4.Yes 5.240 V AC	

Table 3: below shows the 11kV Feeder scheme Protection Panel detailed specification description.

#### 4.2.2. 11KV BUS-SECTION

The 11kV Bus-Section No. 2 couples Busbar 1B to 1C that will connect 11kV Feeder 16 and a 132/11kV Third Transformer Incomer. The MV breaker has controllers and indication lamps which appears on this panel. The specifications of this panel are tabulated in Table No. 3.

#### 4.2.3. 11KV TRANSFORMER INCOMER PANEL

The 5TM-3100 transformer scheme uses the 11kV MV indoor Breaker for the secondary side of the transformer. The transformer protection and controls are embedded within the 5TM-3100 transformer scheme. The MV breaker indication lamps only appear on this panel. The specifications of this panel are as per the ordering schedule in Table No.3 below.

ACTOM MV SWITCHGEAR			DESCRIPTION		4 X SBV3S EXT PANELS		IDZ - EAST LONDON		SPECIFICATION		ES62493 REV 1		
MAIN BOARD LABEL			SS1A4 SS: EXTENSION				COLOUR	VARIES					
VOLTAGE:-		11KV	WIDTH				2 OFF	600mm		20FF	800mm		
FAULT LEVEL:-		25KA	PANEL LABEL			TRFR. 3	TRANSFER FEEDER PANEL 15		BUS-SECTION 2		TRANSFER FEEDER PANEL 16		
INTERNAL ARC		0.2s											
IMPULSE LEVEL:-		95KVip											
BUSBAR RATING				2500A									
CIRCUIT BREAKER/SWITCH	TYPE					SBV3S		SBV3S		SBV3S		SBV3S	
	MEDIUM					VACUUM		VACUUM		VACUUM		VACUUM	
	CURRENT RATING					2400A		2400A		2400A		2400A	
	MECHANISM					M.W.S.		M.W.S.		M.W.S.		M.W.S.	
	HRC STRIKER PIN FUSES												
	MOTOR/CONTACTOR VOLTAGE					110VDC		110VDC		110VDC		110VDC	
	SHUNT TRIP COIL					110VDC		110VDC		110VDC		110VDC	
	SPRING RELEASE COIL					110VDC		110VDC		110VDC		110VDC	
	UNDERVOLTAGE												
	RACKING SWITCH					YES		YES		YES		YES	
INSTRUMENT PANEL EQUIP	SPARE AUX. CONTACTS					6 N/O & 6 N/C		6 N/O & 6 N/C		6 N/O & 6 N/C		6 N/O & 6 N/C	
	INTERGRAL CABLE EARTH					CABLE		CABLE		CABLE		CABLE	
	MECHANICAL INTERLOCKING FOR BB EARTHING					YES		YES		YES		YES	
	BUSBAR EARTHING					CABLE AND EARTH TRUCK				YES - SEPARATE ATTACHMENT			
	COLOUR OF PANEL					G29 GREY		G29 GREY		ORANGE		G29 GREY	
	CONTROL SWITCH					T/N/C		T/N/C		T/N/C		T/N/C	
	SELECTOR SWITCH					LOCAL/REMOTE		LOCAL/REMOTE		LOCAL/REMOTE		LOCAL/REMOTE	
	REMOTE TRIP CLOSE SOCKET					SCAME		SCAME		SCAME		SCAME	
	LAMP TEST PUSH-BUTTON					BLACK		BLACK		BLACK		BLACK	
	INDICATION LED'S - OPEN/CLOSE					GREEN/RED		GREEN/RED		GREEN/RED		GREEN/RED	
INSTRUMENTS	CABLE EARTHED LED					AMBER		AMBER		AMBER		AMBER	
	ITT PLUG					Yes		Yes		Yes		Yes	
	PANEL HEATERS (CABLE/BUSBAR) + SWITCH					220V AC		220V AC		220V AC		220V AC	
	NEON INDICATION												
	M.D.I AMMETER					1 x 0-2400A		1 x 0-2400A				2 x 0-2400A	
	AMMETER SELECTOR SWITCH					YES		YES				YES	
	LOOSE SCALES												
	VOLTMETER												
	VOLTMETER SELECTOR SWITCH												
	POWER QUALITY METER												
RELAYS	CURRENT TRANSUDCERS					YES - CA7		YES - CA7				YES - CA7	
	VOLTAGE TRANSUDCERS												
	KW TRANSUDCER												
	ENERGY METER												
	PROTECTION ESKOM							3CF-4100F ONBOARD SCHEME EXCLUDING INCLUDING DIFFERENTIAL				3CF-4100F ONBOARD SCHEME EXCLUDING INCLUDING DIFFERENTIAL	
	TRIP SUPERVISION												
	PILOT WIRE												
	VOLTAGE SELECTION RELAY												
	ARC PROTECTION (Vamp)					Intergrated in 3BP-4901		Intergrated in 3BP-4901		Intergrated in 3BP-4901		Intergrated in 3BP-4901	
	TEST BLOCK DIFFERENTIAL												
VTS	TEST BLOCK PROTECTION							1 x C & H 13 WAY				1 x C & H 13 WAY	
	TEST BLOCK METERING							1 x C & H 13 WAY				1 x C & H 13 WAY	
			RATIO			110000-110V							
			BRD+ACC			50VA Class 0.2							
			LOCATION										
	DIFFERENTIAL CLASS X					1 X 2400/1 MR							
	PROTECTION CLASS X					1 X 2400/1 MR		2 X 2400/1 MR				2 X 2400/1 MR	
	METERING CLASS 0.2					1 X 2400/1 MR		1 X 2400/1 MR				1 X 2400/1 MR	
	SUMMATION CLASS 0.2 10VA												
CABLES	POWER CABLE ENTRY					BOTTOM		BOTTOM				BOTTOM	
	TERMINATION					GLAND		GLAND				GLAND	
	CLAMP/GLAND/COMPOUND					POLY PROP		POLY PROP				POLY PROP	
	QUANTITY No/CORES/SIZE					12x 1C 630mm²		12x 1C 630mm²				12x 1C 630mm²	
	CABLE TYPE (PILC-PEX)					XLPE		XLPE				XLPE	
	SURGE ARRESTOR					YES		YES				YES	
COMPILED		CD											
CHECKED		CD											
DATE		2023/02/24											

Table 4: Feeder Protection Panel Specification



### Work to be done by **CONTRACTOR**:

- Site Establishment
- Install relevant Primary plant and control plant equipment.
- Procure and delivery equipment with relevant control cables and ancillaries to site.

- Install Panels with the relevant protection schemes and equipment.
- Install and test control cables and communication cables.
- Ensure works are completed in alignment to the Eskom DT Standards
- Quality of works are aligned to Eskom Policies and Procedures.
- Integrate Clerk of Works timeously for approvals where hold points and test, inspection and witnessing is required.
- Ring out all Cables and put labels with ferrules.
- Provide test Certificates and quality documents for Eskom and Engineer to sign.
- Ensure Health and Safety compliance.
- Ensure Environmental Management Plan compliance.
- Connect fibre to remove Solkor relay and test.

➤ **Work to be done by CPM:**

- Eskom to complete the protection, metering, telecontrol and AC/DC commissioning works.
- Eskom to provide clerk of work for all work to be done by the customer.
- Inspecting compliance on OHS and Environmental (EMP).
- Sign test certificates and quality documents upon witnessing and inspections.
- Test signals to control where applicable

#### **4.3. MV BUSZONE PROTECTION:**

##### **4.3.1. 11KV BUSBAR VT'S:**

- Supply and install a new 11kV voltage transformer on the Third section of the Busbar namely Busbar 1C.

##### **4.4. VAMP - PROTECTION PANEL:**

Use existing vamps 3BP-4901 protection scheme to accommodate 2 x 11kV Feeder, Third transformer incomer and Bus-Section by adding the following:

- 14 x Arch Sensors - 5 x arch sensors at Bus-Section
  - 2 x arch sensors at transformer
  - 1 x arch sensors at transformer breaker
  - 1 x arch sensors at each Feeder breaker
  - 2 x arch sensors at each Feeder Busbar
- 3 x trip relay
  - 1 x trip relay for Feeder 16 panel and transformer.
  - 1 x trip relay for Feeder 15
  - 1 x trip relay for Bus-Section No. 2
- Connect 2 x new slave circuits required for the Third Zone.
- 2 x Slave
  - 1 x Slave for Feeder 15
  - 1 x Slave for Feeder 16, Transformer and Bus-Section
- Connect 11kV Feeder 16, Bus-Section and Third 11kV Incomer on the existing vamp module.

- Feeder 15 will utilise Vamp 1 in Zone One.
- Feeder 16, transformer incomer and Bus-Section will utilise Vamp 3

Supply and connect the following materials that will be added to the Vamp Protection Scheme to accommodate the new Feeders, Incomer and Bus-Section:

1. 14\* Arc sensors (max 10 (Ten) per slave unit).
2. 3\* Trip repeat relays (four trip relays per panel).
3. 1\* Current transformer test block (PK2-4way) General Electric.
4. 1\* Diode Terminal (M4/6 SNB), Entrelec
5. 6\* Terminal strips

Table No. 4 below shows the required equipment and their quantities for the vamp protection scheme:

Device	Installed	Required	Total
Light Sensors	54	14	68
Slave units	6	2	8

Table 4: Vamp Protection Scheme Required Equipment and Quantities

- Ensure modules sizes is correct when retrofitting the Vamp panel.
- Ensure that all modules operate on 110V DC auxiliary supply for alarm annunciation. 220V AC for heater circuits.
- All modules can operate from 1A or 5A secondary current transformer circuits. The secondary current selection is made from the front of the master current relays type VAMP220.

Figure No. 2 below shows the existing Panel on Site



Figure 2: Existing Vamp Protection Panel

➤ **Work to be done by *CONTRACTOR*:**

- Site Establishment
- Connect relevant control circuits on the Third Vamp.
- Procure and delivery equipment with relevant control cables and ancillaries to site.
- Ensure works are completed in alignment to the Eskom DT Standards
- Quality of works are aligned to Eskom Policies and Procedures.
- Integrate Clerk of Works timeously for approvals where hold points and test, inspection and witnessing is required.
- Provide test Certificates and quality documents for Eskom and Engineer to sign.
- Ensure Health and Safety compliance.
- Ensure Environmental Management Plan compliance.

➤ **Work to be done by CPM:**

- Eskom shall complete all commissioning works on the Third Busbar vamp.
- Eskom to provide clerk of work for all work to be done by the customer.
- Inspecting compliance on OHS and Environmental (EMP).
- Sign test certificates and quality documents upon witnessing and inspections.
- Test signals to control where applicable

#### **4.5. TELECONTROL**

Supply and install twisted pair wires to IDF rack to cater for the additional hard-wired signals. The Existing D20 RTU will be sufficient to accommodate the new signals of the substation upgrade and will be sufficient to accommodate upgrade transition from analogue to digital communication. The D20 RTU was installed, tested and commissioned by Eskom telecontrol department previously and will be utilised to accommodate the new project scope. Supply and Install a Meinberg GPS Lantime M320 or later model in the remote engineering access panel.

#### **4.6. TELECONTROL COMMISSIONING ACTIVITIES**

- Creating substation records and submit to SCADA.
- Laying of RTU cables in trunking between the RTU and IDF frame (2 days)
- Terminating RTU cables on IDF rack (Three days)
- Installation of IDF cable between breaker panel, Transformer, Bus-Section and IDF (Done by ELIDZ representative)
- Apply earth kits to IDF cables (0,5 day)
- Terminate IDF cables on IDF frame (1 day)
- Cross jumper between RTU side and plant side on the IDF frame (0,5 day)
- Test points with Plant and Control (1 day)
- Test points with SCADA (1 day)
- Cross connect I/O, pre-commission and commission to the Control centre

➤ **Work to be done by Contractor:**

- Supply, install and test twisted pair cables to RTU from Protection panel.
- Supply, install and test Meinberg Lantime M320 in the remote engineering access panel.

➤ **Work to be done by ESKOM CPM:**

- Arrange for station to be taken OFF-Supervisory and commission RTU.
- Inspect quality of installation and RTU detail information.
- All Protection panels must be tested.
- All tests must be performed from the ENMAC to the Primary Plant circuit breaker for all controls.
- Commissioning of Meinberg GPS Lantime M320
- Sign handover document with Service provider.

➤ **Work to be done by ESKOM SCADA:**

- Database configuration of all the stations on ENMAC.
- Commissioning of all the stations to ENMAC.

➤ **Work to be done by CPM Protection:**

- CPM Protection personnel must be present at the day of testing and commissioning to confirm Protection operation via SCADA.
- All Protection panels must be tested on the day of commissioning, to ensure reliable RTU Control operations. All tests must be performed from the ENMAC to the Primary Plant circuit breaker for all controls.

#### **4.7. BATTERY TERMINAL UNIT**

The existing 3-Phase Static Power 110V, 20A,161Ah battery charger, as shown by Figure No. 4 together with an FCP 21 cells 161Amp hour chloride Lead Acid battery bank will be replaced with a new battery including the battery charger. Battery standing load calculations were completed and subsequently submitted to Eskom for verification and are shown below on Table No. 5 and Figure No. 3 below.

The new battery shall be installed by strictly following the following procedure:

- Do not disconnect the existing 110V, 20A, 161Ah battery as it will be utilized as back up during the new battery charger installation process.  
Connect the new switch-mode 110V, 30A, 170Ah battery charger to the AC/DC panel.
- Complete the testing and commissioning works on the new battery.
- Decommission the existing battery charger after loads have been moved over to new battery charger and bank. Transport old charger and batteries to Eskom Rotek stores.

D-DT NO:	SAP NO:	DESCRIPTION	UNIT	QTY
		Supply and install New Battery Charger with Cells. All material necessary to install the equipment shall be part of the rate.		
240-53114248	640920	Supply and install Battery Charger 110V 20A 3Ph CVC, CXC HP, 1xTypeC in S/F. Stock code; 3V11020/CE001	no	1



		CHARGER, BATTERY: TYPE: FIXED FRAME; POWER SOURCE: 110V; OUTPUT: 20A; SPECIFICATION: 240-53114248; 110 V 20A Integrated Battery Charger, 1 Phase 230 V, 2x 110V 1.1kW Rects, CXC HP+1x HV-ADIO, CIS, Ctrl Fuses, DEHNGuard AC Surge, BR5 DC Surge, Type E & Type C Breaker Modules integrated in a 19" swingframe cabinet with blanking plates. VENDORS ARE RESPONSIBLE FOR ENSURING THAT THEY ARE PERFORMING AGAINST THE CORRECT DRAWING REVISION NUMBER (IF APPLICABLE).		
Table 5: New Battery Calculations		110V 20A CVC, LH Swingframe 800x 600x 1800 mm Non-Self Contained. 2x CXRC 1.1kW Rectifiers, 1 x HV ADIO Units, CXC-HP Controller, 1 x Type C Breaker Module (10 32A DP), AC Input Breaker, DEHNguard AC Surge, BR5 DC Surge, CIS, BCB, LCB. 230V 1 Phase AC Input.		
		Supply and install Ethernet cable for remote communication	no	1
<b>217242CE</b>	217242	Supply and install 110V Rectifiers Modules - 1.1kw (To achieve a 30A Charger)	no	1
	670916	Supply and install 170AH Lead Acid Hoppecke batteries - CELL:VR X-FT 12-170;VRLA; GEL; FLAT (5 OSP.HC 175) as per contract 4600066662	no	52
		Swing AC and DC Cable and Decommissioning old Lead Acid cells and transporting to eskom stores	sum	1
		Move existing AC and DC cable to new charger	sum	1
		Maintenance & safety equipment rack for Lead Acid batteries, including jug, funnel, eye-wash bottle, face shield, apron, top-up bottle and rubber gloves	sum	1
		Testing and Commissioning of Battery charger and cells and providing discharge results	sum	1
		All accessories and ancillaries to ensure functionality.	sum	1
		FAT and SAT Testing of battery charger ( Complete FAT and SAT testing with results and Includes Flights and accommodation for Engineer, Eskom and client)	sum	1

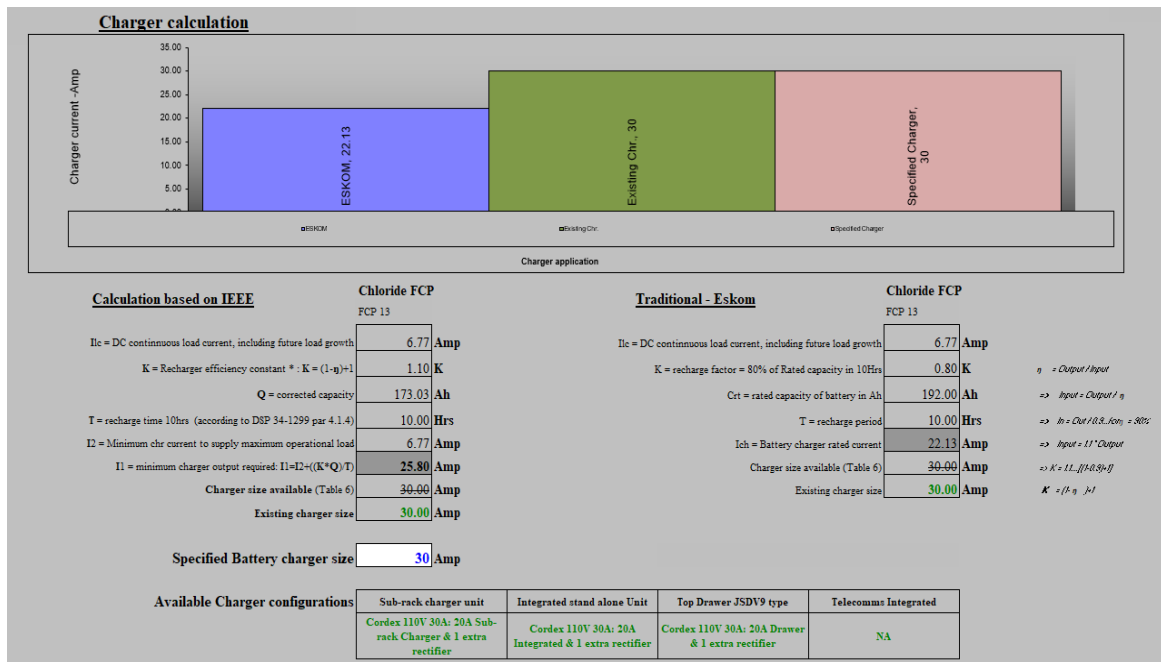


Figure 3: New Battery Calculations



Figure 4: Existing Battery Charger

MAIN DC SYSTEM DESIGN SHEET																																																																																																																																																																																																																	
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<div> <div>LOAD DATA</div> <div> System voltage <b>110</b> Volt DC  Existing substation standing load <b>5.320</b> Amp <small>Required when refurbishing existing substation</small>  Additional aux continuous loads not defined previously <b>0.000</b> Amp <small>For example: CSU current, charger alarm relay current, security fence etc...</small>  Average defined continuous load current <b>6.766</b> Amp <small>(sum of all continuous loads Sh1 2 + Sh13 + existing load + add defined load)</small> </div> </div>																																																																																																																																																																																																																	
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Figure 5: Existing Battery Calculations

<b>Station name :</b>	<u>Leachers Bay 110 Volt</u>
<b>Captured by:</b>	R Viantis
<b>Date:</b>	09/09/2019
<b>Charger Details</b>	
System voltage	110
Type	3v110030B02
Serial number	02/0752
Ac input supply voltage	380 VOLT
DC Output Current	30
<b>Battery details</b>	
Number of cells	54
Type	YCP 13
A/H	161
Date of manufacture	04/2003
<b>Dc loading</b>	
Total DC current drain with rectifier off excluding DC lights	6.232
Total DC current drain with rectifier off including DC lights	7.672
Number of DC circuits	9 Main/3 Back up/4 Spring Rewind
<b>System performance</b>	
Battery A/H with 80 % battery efficiency of actual A/H	128.8
Battery Standby time	16.79
Charger current available for recharge less standing load	22.328
Recharge time in Hours	7.21

Table 6: Existing Battery Calculations

➤ **Work to be done by *CONTRACTOR*:**

- Site Establishment
- Install relevant Primary plant equipment.
- Procure and delivery equipment with relevant control and power cables.
- Install Panels with the relevant protection schemes and equipment.
- Install and test control cables and communication cables.
- Ensure works are completed in alignment to the Eskom DT Standards
- Quality of works are aligned to Eskom Policies and Procedures.
- Transportation of old battery charger and batteries to Eskom Rotek stores.
- Integrate Clerk of Works timeously for approvals where hold points and test, inspection and witnessing is required.
- Ring out all Cables and put labels with ferrules.
- Provide test Certificates and quality documents for Eskom and Engineer to sign.
- Ensure Health and Safety compliance.
- Ensure Environmental Management Plan compliance.

➤ **Work to be done by CPM:**

- Eskom to complete the battery terminal unit commissioning works.
- Eskom to provide clerk of work for all work to be done by the customer.
- Inspecting compliance on OHS and Environmental (EMP).
- Sign test certificates and quality documents upon witnessing and inspections.
- Test signals to control where applicable

#### **4.8. AC/DC PANEL:**

The existing AC Panel will not require any additional 3-Phase Module installed as the current module will be enough to accommodate the Transformer No.3. The Single-Phase AC Modules are sufficient to accommodate the new Feeders, Transformer No.3 and the 11kV Bus-Section No. 2. The main DC supply Module No. 3 has 4 (Four) spare circuits and will be used to accommodate the new Feeders, Transformer No.3 and 11kV Bus-Section No. 2. The scope of work for the AC/DC Panel are as follows:

- Supply and install 25mm<sup>2</sup> cable between NECRT No. 3 and AC Panel.
- Install an AC Yard chop over box without distribution between NECRT No.1 and NECRT No.2 and the AC panel housed in the control room. Install 25mm<sup>2</sup> cable from AC Yard chop over box to AC Panel.
- Utilize the existing Single-Phase AC Modules to accommodate 2 x new Feeder circuits, 11kV Bus-Section and Transformer No. 3 protection panel.
- Use 110V DC existing Back up distribution Module No.1 to accommodate Transformer No. 3 protection panel.
- Use Spring Rewind Module No.3 to accommodate 2 x 11kV Feeder circuits, 11kV Transformer Incoming No.3 and 11kV Bus-Section.
- Use Spring Rewind Module No.1 to accommodate Transformer No. 3 protection panel.
- Use existing DC Module No.1 to accommodate Transformer No.3 circuits.
- Use existing DC Modules No. 3 to accommodate Transformer Incomer No.3, 2 x new 11kV Feeders and Bus-Section No. 2.
- Relabel where necessary.

➤ **Work to be done by CONTRACTOR:**

- Site Establishment
- Install relevant Primary plant equipment.
- Procure and delivery equipment with relevant control cables and ancillaries to site.
- Install Modules with the relevant cabling and AC/DC equipment.
- Install and test control cables and communication cables.
- Ensure works are completed in alignment to the Eskom DT Standards
- Quality of works are aligned to Eskom Policies and Procedures.
- Integrate Clerk of Works timeously for approvals where hold points and test, inspection and witnessing is required.
- Ring out all Cables and put labels with ferrules.
- Provide test Certificates and quality documents for Eskom and Engineer to sign.
- Ensure Health and Safety compliance.
- Ensure Environmental Management Plan compliance.

➤ **Work to be done by CPM:**

- Eskom to complete the AC/DC commissioning works.
- Eskom to provide clerk of work for all work to be done by the customer.
- Inspecting compliance on OHS and Environmental (EMP).
- Sign test certificates and quality documents upon witnessing and inspections.
- Test signals to control where applicable



Figure 6: AC Panel



Figure 7: DC Panel

#### 4.9. ISOLATOR/CURRENT TRANSFORMER JUNCTION BOX:

- Supply and install a Double circuit Busbar isolator junction with inserts box on Transformer No.3 HV Busbar isolators and a single circuit isolator junction box on Transformer No.3 MV isolator junction box.
- Supply and install HV CT's junction box with inserts on Transformer No. 3 HV CT.

➤ **Work to be done by Contractor.**

- Contractor to supply and install all Isolator and current transformer JB's.

## **5. METERING**

### **➤ SCOPE OF WORK:**

#### **5.1. 132/11KV STATISTICAL METERING PANEL:**

A new Stats Meter with metering modules will be installed at this site within the existing Stats metering panel in accordance with Eskom's Metering Standards.

- Move the existing meters downwards to make space for new Vector III Module on the stats metering panel.
- Install Vector III on the new AC Aux and Vector III Module.
- Supply and install a 132/11kV Transformer No.3 Meter Module for Stats Metering below the Two existing meters.
- Supply and install new 0.5 class 1A stats meter on the Meter Module and establish connection to the existing cell modem.
- All Voltage fail relays, Circuit Breakers, Test Blocks, Terminal Strips and all other auxiliary equipment are already installed in the new metering panel in accordance with Eskom's standards.
- Separate each Vector III with a 1u plate and label the Vector III in accordance with its relevant transformer source.

#### **5.1.1. FEEDBACK ON VT'S AND CT'S**

##### **5.1.1.1. FEEDBACK ON 11KV VT'S (BUSBAR 1C)**

- Connect 11kV VT's on transformer 11kV Incomer to the newly installed Stats Meter No.3
- Connect and wire the VT inside the panel.
- Connect new 11kV VT on Busbar 1C supply to new Vectograph.

##### **5.1.1.2. FEEDBACK ON 11KV CT'S**

- Connect and wire the CT inside the panel and connect to Stats Meter panel Transformer No.3.

### **➤ Work to be done by *CONTRACTOR*:**

- Site Establishment
- Install metering and quality modules with the relevant cabling and equipment.
- Install and test control cables and communication cables.
- Ensure works are completed in alignment to the Eskom DT Standards
- Quality of works are aligned to Eskom Policies and Procedures.
- Integrate Clerk of Works timeously for approvals where hold points and test, inspection and witnessing is required.
- Ring out all Cables and put labels with ferrules.
- Provide Test Certificates and Quality Documents for Eskom and Engineer to sign.
- Ensure Health and Safety compliance.
- Ensure Environmental Management Plan compliance.

➤ **Work to be done by CPM :**

- Eskom to complete the stats metering commissioning works.
- Eskom to provide clerk of work for all work to be done by the customer.
- Inspecting compliance on OHS and Environmental (EMP).
- Sign test certificates and quality documents upon witnessing and inspections.
- Test signals to control where applicable



Figure 8: Existing Stats Metering Panel



No.	D-DT	Sapp no.	Description	Unit.	QTY
			Supply and Install - Upgrade of the existing Stats metering panel to accommodate new transformer with the following. All material necessary to install the equipment shall be part of the rate.		
1.4.1	D-DT-9400	175685	Measurements (Sub panel Meter Module) - Stats	no	1
1.4.2	D-DT-9121	183360	ZMD Digital transducer -Triad. According to Eskom drawing D-DT-9121	no	1
1.4.3	D-DT-9420	686395	Meter,ZMD Landis & Gyr, A1700 3PH 1A , Class 0.5, RS232,485	no	1
1.4.4	D-DT-9407	Buy Out	Vector III by CT Lab as per Eskom Standard	no.	1
	D-DT-9403	230644	Quality of Supply - AC Aux and Vector III Module	no.	1
1.4.5		6491	2 X 1U Plates	no.	2
1.4.6			All ancillaries and accessories to ensure function operation.	no.	1
1.4.7			Testing and Commissioning	sum	1

Table 7: Stats Metering Equipment

## 6. EQUIPMENT ERECTION

### 6.1. EQUIPMENT ERECTION

All major equipment panels are to be floor standing as per BOQ and Project Specification.

### 6.2. PANEL ORIENTATION

The orientation of the breaker is to be such that pole A is connected to the blue Phase. The phasing of the existing switchboard is to match the new switchboard panels. The new Busbar is to be aligned to the existing Busbar and sectioned with a 2500A Bus-Section. A transformer incomer will be added in the newly established section, Zone No. 3 which is adjacent to the existing Feeder 12. The new Feeder 16, Transformer No. 3 incomer and Bus -Section will be installed on the new Busbar 1C, left of the board and the new Feeder 15 will be installed on Busbar 1A, on the right of the board. The circuit breaker sizes of Transformer No. 3, 2 x 11kV Feeders and the Bus-Section are as follows:

40 MVA Incomer : I 2500A  
2x11kV Feeders : F 2500A  
Bus-Section : S 2500A

F	I	S	F	F	F	F	F	I	F	F	S	F	F	I	F	F	F	F	F	F
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

## **7. EARTHING AND PHASING**

### **7.1. ELECTRICAL PHASING**

Electrical phasing e.g. (R W B) of the new 11kV Feeder Bay is to be completed as per the phasing of the existing Feeder panel.

### **7.2. EARTHING OF FOUNDATION & EQUIPMENT**

The protection panels shall be earthed using a 2 x (50 x 3mm) flat copper earth tail per panel, bolted to the panel and main trench earth. The existing earth bar may be moved from the existing panel to the new order panel ends.

## **8. LABELING**

Install main panel on existing panels to read as follows:

<b>Panel</b>	<b>Label</b>
Feeder 15	IDZ 1-1 11kV FDR 15
Feeder 16	IDZ 1-1 11kV FDR 16
11Kv TRFR Incomer 3	TRFR. 3 11kV BKR.
Bus-Section No.2	BUS-SECTION 2 11kV BKR
Transformer 3	132/11kV TRANSFORMER 3
Battery Charger	110V BATTERY CHARGER

Table 8: Panel Labels

Install equipment sub labels on schemes as detailed on D-EC-1955 Sheet 1D Rev 23 for 11 kV Feeder Bay. Install equipment labels as detailed on D-EC-1955 Sheet 1D Rev 23 for 11 kV Feeder panels. The labels shall be in accordance with the following drawings:

- D-SR-121 Set 145 Sheet 01 – Feeder 15 & 16
- D-SR-121 Set 55 Sheet 1- Transformer 3
- D-SR-121 Set 54 Sheet 1- Transformer PIU

## **9. CONTROL BUILDING CONSTRUCTION**

### **CONTROL BUILDING**

Protection panels to be installed in the control building for the Feeder Bay as per control panel layout indicated on the next page:

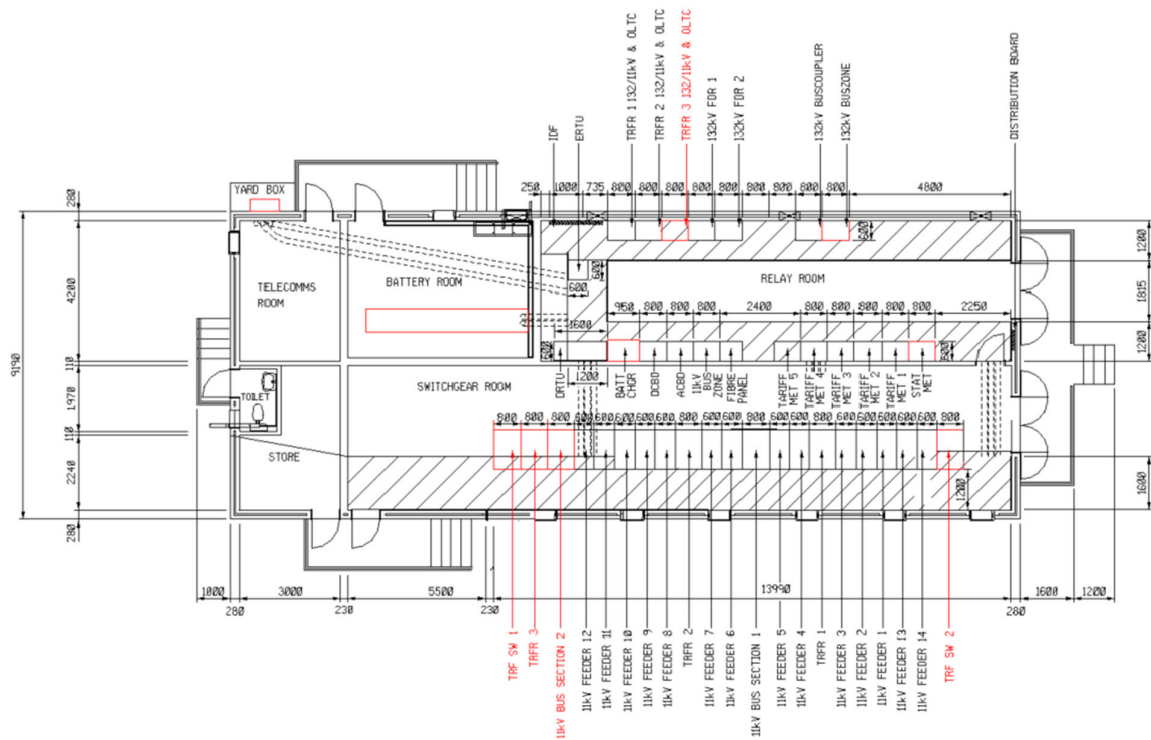


Figure 9: Control Room Layout

## 10. PANEL SUMMARY

The summary of the new panels in the relay and switch room above is below.

Schemes/Modules	Description	Panel
2	TRFR No.3	1
1	Stats Metering Panel	0
1	110V DC 30A Battery charger	1
2	AC/DC Panel	0
0	11kV TRFR No.3 Incomer	1
0	Bus-Section No.2	1
2	11KV Switchboard Feeder Panel (3CF-4100F) with Solkore N relay	2
	<b>TOTAL New Panels</b>	<b>6</b>

Table 9: New Panels

**11. COSTING**

**REFER TO ANNEXTURE B: BILL OF QUANTITIES**

## 12. HEALTH AND SAFETY REQUIREMENTS:

### 12.1. RISK ANALYSIS:

The Service Provider shall perform a Risk Analysis to determine the severity of the risks exposed to during the course of this contract. In terms of the identified risk classification, preventative actions should be implemented. Included in this should be safe working procedures, etc.

The Risk Analysis should include all risks identified by the Service Provider or the Employer; as well as a risk assessment of all work carried out from an elevated position. The Service Provider is also responsible to identify any other risks unique to the specific project that may not be part of the generic list supplied by Eskom. Risks can be evaluated by using a risk assessment matrix.

### 12.2. TYPICAL RISKS:

- Load equipment Injury/Damage/Loss
- Travel to/from worksite Injury/Damage/Loss
- Construction stands Injury/Damage/Loss
- Install equipment Injury/Damage/Loss
- Prepare equipment for installation (off site) Injury/Damage/Loss
- Do pre-commissioning (off site) Injury/Damage/Loss
- Commissioning (on site) Injury/Damage/Loss
- Poisonous or dangerous insects like bees, spiders etc. Injury/Damage
- Poisonous and / or dangerous animals, snakes, material or objects.
- Dangerous situations and terrain e.g., hijack area, restricted area etc.

Item	Main Task	Safe Method of Execution	Risks Dealing with
1	Install and Earth a new 19" Control Panel	Normal approved construction techniques as per OHS Act requirements	Use of an approved panel transporting device or trolley. Beware of working in close proximity of existing live electrical circuits. Employ supervision to ensure safe working clearances. Use of power driven tools. The risk of pinching a finger while moving the panel in place.
2	Making off a Cable with the appropriate size Gland	Normal approved construction techniques as per OHS Act requirements	Beware of working in close proximity of existing live electrical circuits. Employ supervision to ensure safe working clearances. Working with cutting knives, hacksaws and other cable making off equipment. Sharp edges around floor plates holes.
3	Fastening the Glanded cable to the 19" Control Panel Top or Bottom Plate	Normal approved construction techniques as per OHS Act requirements	Sharp edges around floor plates holes. The use of spanners or adjustable wrenches of correct size and purpose. Working in confined spaces and in control room trenches.
4	Attachment of the cable number plates at each cable end	Normal approved construction techniques as per OHS Act requirements	The use of wire, side cutters and pliers.
5	Crimping and Numbering of all connections	Normal approved construction techniques as per OHS Act requirements	The use of crimping tools and working inside panels and in the yard beneath JB's, Circuit breakers and Isolator boxes.

	inside the Control Panel. (Lugs & Numbering)		
6	Transportation of Control Panels	Normal approved construction techniques as per OHS Act requirements	Use of a vehicle mounted crane and truck. Beware of working in close proximity of other existing live electrical circuits. Employ supervision to ensure safe working clearances.
7	Off Loading of Control Panels	Normal approved construction techniques as per OHS Act requirements	Use of a vehicle mounted crane and truck. Beware of working in close proximity of other existing live electrical circuits. Employ supervision to ensure safe working clearances. Use of an approved panel transporting device or trolley.
8	Installation of Control Cables in the Control Room Trenches	Normal approved construction techniques as per OHS Act requirements	Working in confined spaces and in control room trenches. Beware of working in close proximity of existing live electrical circuits. Employ supervision to ensure safe working clearances.
9	Installation of Control Cables in the Control Room overhead cable racks	Normal approved construction techniques as per OHS Act requirements	Working in confined spaces and on control room cable racks. Beware of working in close proximity of existing live electrical circuits. Employ supervision to ensure safe working clearances. Working on and with ladders and associated tools.
10	Install & Earth of CT/VT Junction Box	Normal approved construction techniques as per OHS Act requirements	Beware of working in close proximity of existing live electrical circuits. Employ supervision to ensure safe working clearances. The use of fastening straps, side cutters and pliers. The use of spanners or adjustable wrenches of correct size and purpose.
11	Modify & Install chequer Plate covers over Trenches in the Control Room	Normal approved construction techniques as per OHS Act requirements	Be aware of loose existing trench covers. Make sure trench covers are placed back onto the trench bracket in the correct manner. Be aware of open trench covers. Use of power driven tools and grinders. Ensure that the necessary protective equipment is used when cutting the new plates to size.
12	Working at heights	Normal approved construction techniques as per OHS Act requirements.	Using FAS when working above 2m above ground level.
13	Fibre installations like stringing /splicing	Normal approved construction techniques as per OHS Act requirements.	Beware of working in close proximity of existing live electrical circuits. Employ supervision to ensure safe working clearances. Beware of laser beams when using test equipment.

Table 10: Health and Safety requirements

### 12.3. REQUIREMENTS FOR THE HEALTH AND SAFETY FILE.

#### SEE CONTRACTOR HEALTH & SAFETY REQUIREMENTS DOCUMENT 32-136

The Health and Safety file contains various documents that relates to the entire history of the project. The Service Provider should ensure that this file is kept up to date. On completion of the construction work the Service Provider shall hand over the file to the Employer on request.

The Health and Safety file should contain the following folders, and relevant documents should be filed under these folders:

- A copy of the OHS Act, 1993 and its regulations.
- The Tunnelling Regulations as published under the Mine Health and Safety Act, 1996, in case of tunnelling being done.

- All agreements in terms of section 37(2) between the client and principal Service Provider.
- Tender documentation.
- Copies of all health and safety plans.
- Any other risk assessment not foreseen at the time the health and safety plan was done.
- All letters of appointment.
- Copy of notification of construction work.
- Inspection registers or checklists.
- Certificates of Compliance for electrical installations.
- Monthly audit reports.
- Drawings and Designs.
- Fall Protection plan.
- Detailed structural engineering survey of structures to be demolished.
- In case of scaffolding used: a certificate of a system design for suspended scaffolding together with proof that it was forwarded to the Department of Labour.
- Inspection records of designers.
- Safe work procedures.
- Evacuation plans

#### **12.4. ACCEPTANCE OF THE SERVICE PROVIDER'S HEALTH AND SAFETY PLAN**

Intervals for periodic audits:

The Employer may conduct periodic audits to ensure that the Service Provider's Health and Safety Plan is implemented and maintained at the Construction site.

##### **12.4.1. THE SERVICE PROVIDER'S AGREEMENT:**

The Service Provider agrees to implement the Health and Safety Plan as outlined above and as stipulated in the Construction Regulations (2003). In addition, the Service Provider undertakes maintain and to hand over a comprehensive Health and Safety File to the Employer on completion of the project, containing.

- Emergency contact details
- Medical records
- Maintenance records for Machinery and equipment
- Incident investigations reports and notifications thereof.
- Annexure 2's (Incident recording forms)
- Material Safety Data Sheets of Chemicals
- Minutes of H&S Committee meetings
- Training Records
- Personal Protective Equipment Records
- Examination & test records of equipment

The above is not an exhaustive list. Service Providers shall add any other documentation that is regarded as reasonable and relevant.

#### **12.4.2. RISK IDENTIFIED BY DESIGN:**

At all instances, access to high-voltage apparatus and equipment must be strictly controlled; no person shall carry out work of any description, on any part of high-voltage apparatus, unless:

- Those parts are opened and,
- Those parts are isolated,
- All practical steps are taken to lock such apparatus off from all live conductors.
- Safety tested,
- Effectively and adequately connected to earth at all points of disconnection from supply to such apparatus,
- And earthed on both sides of the workplace.
- Barricaded (screened off) to prevent danger – warning notices affixed.
- Released for work by the issue of a work permit.

The risk analysis and workers register must be completed in conjunction with the relevant Regulations to safeguard the continuity of supply and obey safety rules and operating regulations.

#### **12.4.3. RISK IDENTIFIED ON SITE:**

Every employee or service provider not authorized shall work under the authority of an authorized person and take reasonable care for the health and safety of him/her and other persons who may be affected by his acts or omissions and obey the health and safety rules and procedures.

If any situation which is unsafe or unhealthy comes to his/her attention, as soon as possible or practicable, such situation must be reported to the authorized person.

Control must be exercised over system conditions and operating procedures at all times.

#### **12.4.4. POSSIBLE RISKS FOR THE WORK AT THESE POINTS:**

Before attempting any work at the designated substation or premises, care must be taken that the following steps are carried out:

- Trenches, care must be taken not to be injured in open trenches.
- Electricity: 220VAC points isolated before working on SCADA equipment.
- Open or loose electric wires.
- Ground level: For SCADA and DC projects nobody must leave ground level at any time.

#### **12.4.5. LIFE SAVING RULES:**

- Any person who performs any work on the distribution network shall ensure that the network has been opened, isolated, tested and earthed as per the ORHVS. All work must be performed between Two visible working earths. This rule shall exclude all work being performed as live work operation.



- Any person who must for any reason perform work higher than Two meters above ground level must wear a fall arrest system and be attached to an anchor point at all times.
- Any person driving a vehicle or being a passenger whilst busy with the performance of their duties will at all times wear the seatbelt provided in the vehicle.
- Any person driving a vehicle whilst busy with the performance of his/her duties will under no circumstances be under the influence of intoxicating liquor or drugs.
- No person shall work without the required Permit to Work (PTW)

#### 12.4.6. ENVIRONMENTAL

- Unique Identifier: 240-89797258 with the title: The Safe Handling, Transportation And Disposal Of Cells, Batteries And Electrolyte to be adhered to at all times, by both contractors and CPM (ESKOM).
- SHEQ Policy 32-727

#### 13. TRENCHES/EXCAVATIONS:

➤ N/A

#### 14. LIST OF SPECIFICATIONS

Document No.	Revision No.	Description	Attached (Y/N)
SCSASABK3	0	Generic Substation Design	N
240-56062704	2.1	The DX and TX specification for 11kV to 33kV fixed pattern metal-enclosed indoor primary switchgear standard	N
240-56065131	3	The DX and TX specification for 6.6kV to 33kV withdrawable indoor metal-enclosed switchgear	N
240-46264031	2	Fibre-optic design standard – part 2: substations	N
240-120804300	-	Standard for the labelling of electrical equipment within Eskom wires networks	N
240-46425213	-	Cable testing – control plant	N
240-54615413	-	Standard for commissioning protection assets	N
240-62629353	-	Specification for panel labelling standard	N
240-64100247	-	Standard for earthing of secondary plant equipment in substations	N
D-DT 34-276	-	Covering of cable trenches	N
D-DT-9420	6	Meters	
D-DT-9400	4	Meter Module	N
D-DT-9023	4	Vamp Protection	
D-DT 34-284	-	Installation of control cables in sub-transmission sub-stations	N
D-DT 41-267	-	Standard for labelling of secondary plant equipment's	N
D-DT-5022	-	Control and relay panel engraving and labelling requirements.	
D-DT 5240	1	Earthing standard earthing of signal distribution frames	N
D-DT 5413	1	Substation typical protection panel layouts	N
SANS 121:2011 or ISO 1461:2009	-	Hot dip (Galvanised) zinc coatings (other than on continuously zinc-coated sheet and wire	N
DST 34-209	1	MV Cabling in Substation	N
DSP 34-1974	0	Substation Connectors.	N

Document No.	Revision No.	Description	Attached (Y/N)
DST 34-1175	0	General information and requirements for medium-voltage cable systems	N
DPC 34-333	1	Health and Safety requirements to be met by Principal Contractor employed by Eskom Distribution.	Y
DSP 34-1622	1	Accessories for medium-Voltage Power Cables for Systems with Nominal Voltages of 11kV to 33kV.	N
SABS 10198-13	1988	The selection, handling and installation of electric power cables of rating not exceeding 33kV Part 13: Testing, commissioning and fault location	N
DST 34-1245	0	Substation Earthing	N
DISASAAQ1	5	Quality checking of distribution substation construction before handing over for commercial operation	
IEEE 81	-	Guide for measuring earth resistivity, ground impedance and earth surface potentials of a ground system.	N
SABS 920	-	Steel bars for concrete reinforcement.	N
SABS 1186	-	Symbolic safety signs.	N
SABS 1200A	-	Standardized specifications for civil engineering construction – A General.	N
SABS 1200AA	-	Standardized specifications for civil engineering construction – AA General (small works).	N
SABS 1200C	-	Standardized specifications for civil engineering construction – C Site Clearance.	N
SABS 1200D	-	Standardized specifications for civil engineering construction – Earthworks	N
SABS 1200DA	-	Standardized specifications for civil engineering construction – Earthworks (small works).	N
SABS 1200LB	-	Standardized specifications for civil engineering construction – LB Bedding (pipes).	N
SABS 1200DB	-	Standardized specifications for civil engineering construction – DB Earthworks (pipe trenches).	N
SABS 1200G	-	Standardized specifications for civil engineering construction – G Concrete (structural).	N
SABS 1200GA	-	Standardized specifications for civil engineering construction – GA Concrete (small works).	N
SABS 1200GB	-	Standardized specifications for civil engineering construction – GB Concrete (ordinary buildings).	N
SABS 1200H	-	Standardized specifications for civil engineering construction – H Structural steelwork.	N
SABS 1200HA	-	Standardized specifications for civil engineering construction – HA Structural steelwork (sundry items).	N
SABS 1200HC	-	Standardized specifications for civil engineering construction – HC Corrosion protection of structural steelwork.	N
SABS 1200MK	-	Standardized specifications for civil engineering construction – MK Kerbing and channelling.	N
SANS 1019.	-	The design and installation of an earth electrode.	N
SABS 0164	-	The structural use of masonry. – All parts.	N
SANS 60060-1	-	General -definitions and test requirements	N
ESKPBAAA9	-	Environmental impact assessment policy.	N
ESKPBAAD6	-	Environmental management policy.	N
ESKPVAAL7:	-	Environmental impact assessment procedure.	N
DISASAAA0S	-	Standard for passive fire protection in distribution substation yards.	N
DST 34-1985	-	MV and LV reticulation earthing.	N
DST_34-195	-	Distribution group's specific requirements for standard drawing practice for substation design layout.	N

Table 11: Lists of Specifications

**15. LIST OF DRAWINGS**

Drawing Number	Set No.	Sheet No.	Rev	Description	Attache d (Y/N)
CONTROL ROOM AND PANEL LAYOUT					
D-SR-121	114	01	01	SWITCHGEAR ROOMAND RELAY ROOM	N
D-SR-121		02	02	SWITCHGEAR ROOMAND RELAY ROOM	N
D-SR-121		03	02	SWITCHGEAR ROOMAND RELAY ROOM	N
CABLE BLOCK DIAGRAM					
D-SR-121	113	01	02	132 KV FDRS CABLE BLOCK	N
D-SR-121		02	02	132/11 KV TRFRS & OLTC CABLE BLOCK	N
D-SR-121		03	02	132 KV BUSCOUPLER CABLE BLOCK	N
D-SR-121		04	02	11 KV FDRS CABLE BLOCK	N
D-SR-121		4a	00	11 KV FDRS CABLE BLOCK	N
D-SR-121		05	03	AUXILLIARIES CABLE BLOCK	N
11KV FEEDER DRAWINGS					
D-SR-121	145	00	00	COVER SHEET	N
D-SR-121		01	00	PANEL EQUIPMENT LAYOUT	N
D-SR-121		02	00	AC KEY DIAGRAM LAYOUT	N
D-SR-121		03	00	DC KEY DIAGRAM	N
D-SR-121		04	00	DC KEY DIAGRAM	N
D-SR-121		05	00	DC KEY DIAGRAM	N
D-SR-121		06	00	DC KEY DIAGRAM	N
D-SR-121		07	00	REMOTE ACCESS KEY DIAGRAM	N
D-SR-121		08	00	SUPERVISORY KEY DIAGRAM	N
D-SR-121		09	00	REFERENCE DIAGRAM	N
D-SR-121		10	00	CABLING DIAGRAM	N
D-SR-121		11	00	CABLING DIAGRAM	N
D-SR-121		12	00	CABLING DIAGRAM	N
D-SR-121	146	00	00	COVER SHEET	N
D-SR-121		01	00	PANEL EQUIPMENT LAYOUT	N
D-SR-121		02	00	AC KEY DIAGRAM LAYOUT	N
D-SR-121		03	00	DC KEY DIAGRAM	N
D-SR-121		04	00	DC KEY DIAGRAM	N
D-SR-121		05	00	DC KEY DIAGRAM	N
D-SR-121		06	00	DC KEY DIAGRAM	N
D-SR-121		07	00	REMOTE ACCESS KEY DIAGRAM	N
D-SR-121		08	00	SUPERVISORY KEY DIAGRAM	N
D-SR-121		09	00	REFERENCE DIAGRAM	N
D-SR-121		10	00	CABLING DIAGRAM	N
D-SR-121		11	00	CABLING DIAGRAM	N
D-SR-121		12	00	CABLING DIAGRAM	N

132/11KV TRANSFORMER					
D-SR-121	55	00	00	COVER SHEET	N
D-SR-121		01	00	PANEL LAYOUT	N
D-SR-121		02	00	SCHEME SHELL EQUIPMENT LAYOUT	N
D-SR-121		03	00	MAIN EQUIPMENT LAYOUT	N
D-SR-121		04	00	BACK-UP EQUIPMENT LAYOUT	N
D-SR-121		05	00	TAP CHANGE EQUIPMENT LAYOUT	N
D-SR-121		06	00	CUST DIFF EQUIPMENT LAYOUT	N
D-SR-121		07	00	SCHEME LOGIC DIAGRAM	N
D-SR-121		08	00	TAP CHANGE EQUIPMENT LAYOUT	N
D-SR-121		09	00	AC KEY DIAGRAM	N
D-SR-121		11A	00	AC KEY DIAGRAM	N
D-SR-121		12	00	VT SUPPLY DIAGRAM	N
D-SR-121		13	00	COMMON DC KEY DIAGRAM	N
D-SR-121		14	00	COMMON DC KEY DIAGRAM	N
D-SR-121		15	00	MAIN DC KEY DIAGRAM	N
D-SR-121		16	00	BACK-UP DC KEY DIAGRAM	N
D-SR-121		17	00	BACK-UP DC KEY DIAGRAM	N
D-SR-121		18	00	TAP CHANGE KEY DIAGRAM	N
D-SR-121		19	00	CUST. DIFF. DC KEY DIAGRAM	N
D-SR-121		20	00	AC KEY DIAGRAM	N
D-SR-121		21	00	CB FAIL KEY DIAGRAM	N
D-SR-121		22	00	SUPERVISORY/COMS KEY DIAGRAM	N
D-SR-121		23	00	COMMS KEY DIAGRAM	N
D-SR-121		24	00	REFERENCE DIAGRAM	N
D-SR-121		25	00	REFERENCE DIAGRAM	N
D-SR-121		26	00	REFERENCE DIAGRAM	N
D-SR-121		27	00	REFERENCE DIAGRAM	N
D-SR-121		28	00	SCHEME SHELL CABLING DIAGRAM	N
D-SR-121		29	00	SCHEME SHELL CABLING DIAGRAM	N
D-SR-121		30	00	SCHEME SHELL CABLING DIAGRAM	N
D-SR-121		31	00	MAIN MODULE CABLING DIAGRAM	N
D-SR-121		32	00	MAIN MODULE CABLING DIAGRAM	N
D-SR-121		33	00	BACK-UP MODULE CABLING DIAGRAM	N
D-SR-121		34	00	BACK-UP MODULE CABLING DIAGRAM	N
D-SR-121		35	00	TAP CHANGE CABLING DIAGRAM	N
D-SR-121		36	00	TAP CHANGE CABLING DIAGRAM	N
D-SR-121		37	00	CUST.DIFF. MODULE CABLING DIAGRAM	N
D-SR-121			38	00	CABLE BLOCK DIAGRAM
5JB-3200					
D-SR-121	56	00	00	COVER SHEET	N
D-SR-121		01	00	JB FRONT EQUIPMENT LAYOUT	N
D-SR-121		02	00	JB REAR TERMINAL LAYOUT	N
D-SR-121		03	00	AC KEY DIAGRAM	N

D-SR-121		04	00	AC KEY DIAGRAM	N
D-SR-121		05	00	SUPPLY DC KEY DIAGRAM	N
D-SR-121		06	00	MAIN DC KEY DIAGRAM	N
D-SR-121		07	00	MAIN DC KEY DIAGRAM	N
D-SR-121		08	00	MAIN DC KEY DIAGRAM	N
D-SR-121		09	00	MAIN DC KEY DIAGRAM	N
D-SR-121		10	00	MAIN DC KEY DIAGRAM	N
D-SR-121		11	00	BACK-UP DC KEY DIAGRAM	N
D-SR-121		12	00	COMMON CIRCUITS DC KEY DIAGRAMS	N
D-SR-121		13	00	MOTORISED ISOL DC KEY DIAGRAM	N
D-SR-121		14	00	MOTORISED ISOL DC KEY DIAGRAM	N
D-SR-121		15	00	MOTORISED ISOL DC KEY DIAGRAM	N
D-SR-121		16	00	MOTORISED ISOL DC KEY DIAGRAM	N
D-SR-121		17	00	MOTORISED ES DC KEY DIAGRAM	N
D-SR-121		18	00	MOTORISED ES DC KEY DIAGRAM	N
D-SR-121		19	00	MOTORISED ES DC KEY DIAGRAM	N
D-SR-121		20	00	MOTORISED ES DC KEY DIAGRAM	N
D-SR-121		21	00	SPRING REWIND DC KEY DIAGRAM	N
D-SR-121		22	00	COMMON CIRCUITS DC KEY DIAGRAMS	N
D-SR-121		23	00	COMMON CIRCUITS DC KEY DIAGRAMS	N
D-SR-121		24	00	COMMON CIRCUITS DC KEY DIAGRAMS	N
D-SR-121		25	00	TAP CHANGE AC/DC KEY DIAGRAM	N
D-SR-121		26	00	TAP CHANGE DC KEY DIAGRAM	N
D-SR-121		27	00	TAP CHANGE AC KEY DIAGRAM	N
D-SR-121		28	00	ANALOGUE mA AND COMMS KEY DIAGRAM	N
D-SR-121		29	00	230 VOLT AC KEY DIAGRAM	N
D-SR-121		30	00	VOLTAGE SELECTION & BUSZONE DC KEY DIAGRAM	N
D-SR-121		31	00	VOLTAGE SELECTION & BUSZONE DC KEY DIAGRAM	N
D-SR-121		32	00	REFERENCE DIAGRAM	N
D-SR-121		33	00	CABLING DIAGRAM	N
D-SR-121		34	00	CABLING DIAGRAM	N
D-SR-121		35	00	CABLING DIAGRAM	N
D-SR-121		36	00	CABLING DIAGRAM	N
D-SR-121		37	00	CABLING DIAGRAM	N
D-SR-122		37	00	CABLING DIAGRAM	N
<b>BUSZONE DRAWINGS</b>					
D-SR-121	99	00	02	COVER SHEET	N
D-SR-121		01	02	PANEL LAYOUT	N
D-SR-121		02	02	LOGIC DIAGRAM	N
D-SR-121		03	01	AC KEY DIAGRAM LAYOUT	N
D-SR-121		04	03	DC KEY DIAGRAM	N
D-SR-121		05	02	DC KEY DIAGRAM	N
D-SR-121		06	01	DC & SUPERVISORY KEY DIAGRAM	N

D-SR-121		07	02	VAMP LAYOUT	N
D-SR-121		08	00	VAMP LAYOUT	N
D-SR-121		09	00	RELAY REF DIAG	N
D-SR-121		10	01	CABLING DIAGRAM	N
D-SR-121		11	02	CABLING DIAGRAM	N
<b>AC PANEL</b>					
D-SR-121	111	01	01	PANEL EQUIPMENT LAYOUT	N
D-SR-121		02	02	LABEL SCHEDULE	N
D-SR-121		03	02	TERMINAL PLATE ARRANGEMENT	N
D-SR-121		04	01	400V AC CHOPOVER MODULE EQUIP L/O	N
D-SR-121		05	01	400V AC CHOPOVER MODULE KEY DIAG	N
D-SR-121		06	00	MAIN AC INCOMING MODULE EQUIP L/O	N
D-SR-121		07	03	MAIN AC INCOMING MODULE KEY DIAG	N
D-SR-121		08	01	400V AC DISTR MODULE 1 EQUIP L/O	N
D-SR-121		09	01	400V AC DISTR MODULE 1 KEY DIAG	N
D-SR-121		10	01	400V AC DISTR MODULE 1 KEY DIAG	N
D-SR-121		11	01	400V AC DISTR MODULE 2 KEY DIAG	N
D-SR-121		12	01	320V AC DISTR MODULE 1 EQUIP L/O	N
D-SR-121		13	01	230 AC DISTR MODULE 1 KEY DIAG	N
D-SR-121		14	01	230 AC DISTR MODULE 2 EQUIP L/O	N
D-SR-121		15	01	230 AC DISTR MODULE 2 KEY DIAG	N
D-SR-121		16	01	230 AC DISTR MODULE 2 EQUIP DIAG	N
D-SR-121		17	01	230 AC DISTR MODULE 2 KEY DIAG	N
D-SR-121		18	03	DC PANEL CABLING DIAGRAM	N
D-SR-121		19	03	DC PANEL CABLING DIAGRAM	N
<b>DC PANEL</b>					
D-SR-121	112	01	02	PANEL EQUIPMENT LAYOUT	N
D-SR-121		02	02	LABEL SCHEDULE	N
D-SR-121		03	01	TERMINAL PLATE ARRANGEMENT	N
D-SR-121		04	00	DC INTERFACE MODULE EQUIPMENT LAYOUT	N
D-SR-121		05	02	DC INTERFACE MODULE KEY DIAGRAM	N
D-SR-121		06	01	110V DC MAIN DISTR MODULE 1 EQUIPMENT LAYOUT	N
D-SR-121		07	01	110V DC MAIN DISTR MODULE 1 KEY DIAGRAM	N
D-SR-121		08	01	110V MAIN DISTR MODULE 2 EQUIPMENT LAYOUT	N
D-SR-121		09	01	110V DC MAIN DISTR MODULE 2 KEYB DIAGRAM	N
D-SR-121		10	01	110V DC MAIN DISTR MODULE 3 EQUIPMENT LAYOUT	N
D-SR-121		11	02	110 DC MAIN DISTR MODULE 3 KEY DIAGRAM	N
D-SR-121		12	01	110V DC BACKUP DISTR MODULE 1 EQUIPMNT LAYOUT	N
D-SR-121		13	01	110V DC BACKUP DISTR MODULE 1 KEY DIAGRAM	N

D-SR-121		14	01	FUTURE 110V DC BACKUP DISTR MODULE 2 EQUIP LAYOUT	N
D-SR-121		15	01	FUTURE 110V DC BACKUP DISTR MODULE 2 KEY	N
D-SR-121		16	01	110V DC SPRING REWIND MODULE 1 EQUIPMENT LAYOUT	N
D-SR-121		17	01	110V DC SPRING REWIND DISTR MODULE 1 KEY DIAGRAM	N
D-SR-121		18	01	110V DC SPRING REWIND DISTR MODULE 2 EQUIP LAYOUT	N
D-SR-121		19		110V DC SPRING REWIND DISTR MODULE 2 KEY DIAGRAM	N
D-SR-121		20	01	110V DC SPRING REWIND DIST MODULE 3 EQUIP L/O	N
D-SR-121		21	01	110V DC SPRING REWIND DISTR MODULE 3 KEY DIAG	N
D-SR-121		22	02	DC PANEL CABLING DIAGRAM	N
STATS METERING					
D-SR-121	22	1	01	EQUIPMENT DIAGRAM	N
D-SR-121		2	01	KEY DIAGRAM	N
D-SR-121		3	01	CABLNG DIAGRAM	N

Table 12: Drawing Schedule

**16. GLANDS SCHEDULE**

Table 13: Cable Schedule

		Gland			
	Count	0	1	2	3
10 PR	0				
12 DCV	15			40	
12 ECV	3				10
19 DCV	7			18	
19 ECV	1				4
2 HCV	0		0		
20 PR	0		0		
4 DCV	16		40		
4 ECV	34		86		
4 KCV	2				6
50 PR	2	6		4	
Total		6	126	61	19

Table 14: Cable Glands Schedule

**17. ANNEXURES:**

- A. Protection Single Line Diagram
- B. Control Room Layout
- C. Bill Of Quantities

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RALPH REDDY  
Asset Design Manager Control Plant

**DISTRIBUTION LIST:**

Network Planner	:	Boitumelo Lepman
Control Plant Engineer	:	Gregg Burger
HV Lines Engineer	:	Luvo Ntseke
Internal PE	:	Marc Gallant
Environmental Manager	:	Angelina Shalang
Head of Plant Engineer	:	Melumzi Zamxaka
CNC Supervisor	:	Preston Macka
Grid Access Unit	:	Tembi Plaatjie
Standard Implementation	:	Taelo Phali
Project Settings	:	Archie Mabula
Chief Engineer - Technology	:	Andrew Craib
Bigen Project Lead	:	Nadeem Goolam Hoosen
Bigen Design Engineer	:	Bernard Muanda
Bigen Design Engineer	:	Wandile Palmer

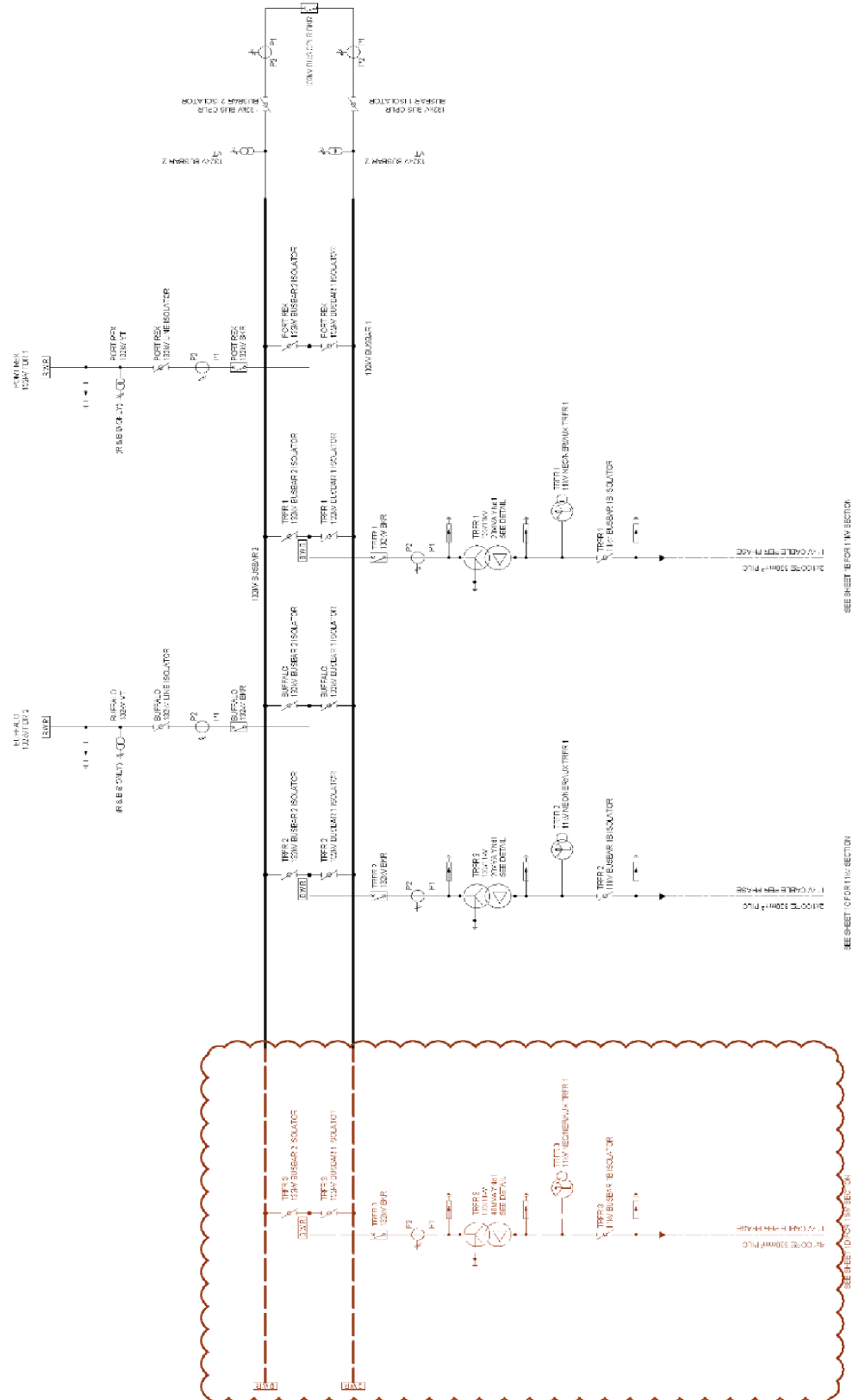


**ANNEXE A**

**SINGLE LINE DIAGRAM**

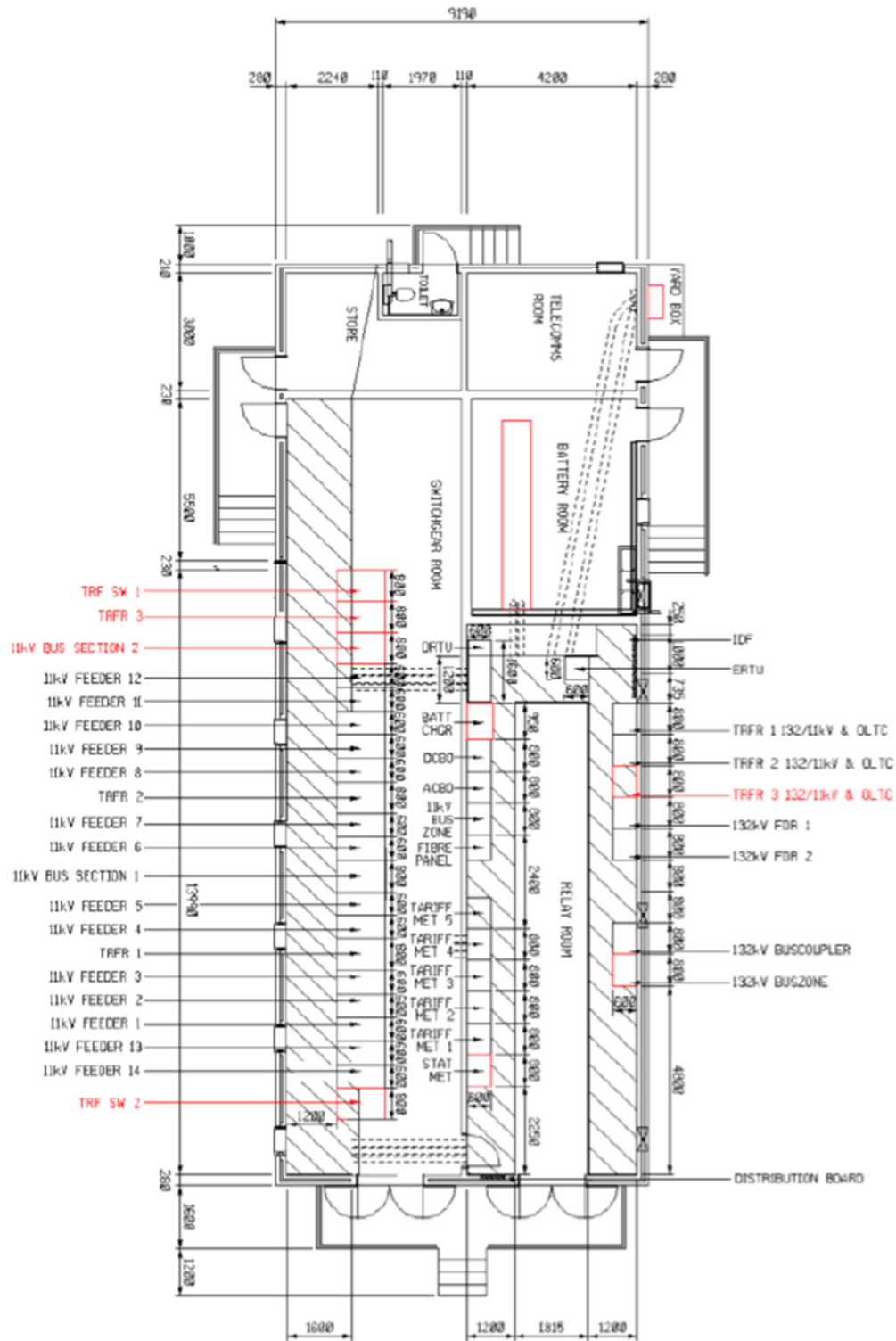


10Z TRANSFER FOR 2  
11KZ FOR 15



**ANNEXE B**

**CONTROL ROOM LAYOUT**



**BILL OF QUANTITIES**